

REMARKS

Status of the Claims

Upon entry of the present amendment, claims 1-33 remain pending in the above-identified application, with claims 1, 3-5, 7 and 25-33 standing ready for further action on the merits, and remaining claims 2, 6 and 8-24 being withdrawn from consideration based on an earlier restriction requirement of the Examiner. New claims 25-33 have been added.

Support for newly added claim 25 can be found at page 8, lines 8-16 of the present specification.

Support for newly added claims 26-27 can be found at page 8, lines 19-23 of the present specification.

Support for newly added claim 28 can be found at page 8, lines 25-29 of the present specification.

Support for newly added claim 29 can be found at page 8, lines 31-34 of the present specification.

Support for newly added claim 30 can be found at page 8, lines 31-35 of the present specification.

Support for newly added claims 31-33 can be found at page 9, lines 26-33 of the present specification.

Accordingly, the present amendments to the claims do not introduce new matter into the application as originally filed. As such entry of the instant amendment and favorable action on the merits is earnestly solicited at present.

Election of Species Requirement

The Examiner has made the Election of Species Requirement final, and has withdrawn claims 2, 6 and 8-24 from further consideration.

Applicants affirm their prior election, and additionally ask for rejoinder of process claims 8-12, which all ultimately depend from process claim 7 of the elected invention.

It is additionally noted also that newly added process claims 25-33 depend from claim 1 and are encompassed by the previously elected invention and are proper for examination and consideration at present.

Claim Rejections under 35 U.S.C. §103(a)

Claims 1, 3-5 and 7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over **Cornubert et al.** (*Bulletin de la Societe chimique de France*, 1950, pages 36-40).

Claims 1, 3-5 and 7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over **Cornubert et al.**, in view of **Mazzieri et al.** (*Reaction Kenetics Catalysis Letters*, Vol. 81 (1), pages 107-112 (2004)).

Claims 1, 3-5 and 7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over **Fosker et al.** (*GB 1315630*), in view of **Mazzieri et al.**

Reconsideration and withdraw of each of the above rejections is respectfully requested based on the following considerations.

Legal Standard for Determining Prima Facie Obviousness

M.P.E.P. § 2141 sets forth the guidelines in determining obviousness. First, the Examiner has to take into account the factual inquiries set forth in *Graham v. John Deere*, 383

U.S. 1, 17, 148 USPQ 459, 467 (1966), which has provided the controlling framework for an obviousness analysis. The four *Graham* factors are:

- (a) determining the scope and content of the prior art;
- (b) ascertaining the differences between the prior art and the claims in issue;
- (c) resolving the level of ordinary skill in the pertinent art; and
- (d) evaluating any evidence of secondary considerations.

Graham v. John Deere, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966).

Second, the Examiner has to provide some rationale for determining obviousness. MPEP § 2143 sets forth some rationales that were established in the recent decision of *KSR International Co. v Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007). Exemplary rationales that may support a conclusion of obviousness include:

- (a) *combining prior art elements according to known methods to yield predictable results;*
- (b) *simple substitution of one known element for another to obtain predictable results;*
- (c) *use of known technique to improve similar devices (methods, or products) in the same way;*
- (d) *applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;*
- (e) *"obvious to try" – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success*
- (f) *known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art;*

- (g) *some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.*

As the M.P.E.P. directs, all claim limitations must be considered in view of the cited prior art in order to establish a *prima facie* case of obviousness. See M.P.E.P. § 2143.03.

The Present Invention and Its Advantages

One of the most important characteristic features of the elected embodiment of the present invention resides in that the reaction is carried out in the presence of a metal catalyst in a mixed solvent of an aprotic solvent and an alcohol solvent. The presence of both an aprotic solvent and an alcohol solvent is essential in the elected embodiment of the present invention. In this respect, instant independent process claim 1 recites as follows (*emphasis added*):

A process for preparing tetrahydropyran-4-one represented by the formula (1):



which comprises reacting at least one kind of dihydropyran-4-one and pyran-4-one represented by the formula (2):



*wherein \equiv represents a single bond or a double bond,
and hydrogen*

(a) in the presence of a metal catalyst, in a mixed solvent of an aprotic solvent and an alcohol solvent, or

(b) in the presence of an anhydrous metal catalyst in which a hydrated metal catalyst is subjected to dehydration treatment, in a hydrophobic organic solvent.

Distinctions over the Cited Art

Distinctions over Cornubert et al.

Cornubert et al. is mentioned in paragraph [0003] bridging pages 1 and 2 of the present specification as Non-Patent literature 1. In this reference, there is disclosed a method in which pyran-4-one and hydrogen are reacted in the presence of Raney nickel, under normal pressure in ethanol at room temperature for 3 hours to prepare tetrahydropyran-4-one with a yield of 58%. This yield was calculated from the description of **Cornubert et al.** (*i.e.*, page 37, right column, lines 1 to 4 and 10 to 16 thereof), wherein from 10 g of pyranone (M.W.=96), 6 g of tetrahydropyranone (M.W.=100) was obtained so that the yield is $(6/100)/(10/96) \times 100 = 57.6\%$.

Thus, the yield of the product obtained in this reference is not so high as compared with that of the present invention (for example, yield: 85.4% in Example 5 on page 25 of the present specification; and 71% in Example 8 on page 27 of the same).

Because **Cornubert et al.** uses only ethanol as a solvent and the yield of the product is not so high as compared with the present invention, it is submitted that the present invention is in no way rendered obvious by the disclosure of **Cornubert et al.** Any contentions of the USPTO to the contrary must be reconsidered at present.

Distinctions over Cornubert et al. in view of Mazzieri et al.

Distinctions between the present invention and **Cornubert et al.** are mentioned above.

Mazzieri et al. discloses partial hydrogenation of benzene to cyclohexane in a mixed solvent of benzene and methanol. In **Mazzieri et al.**, some portion of benzene may be a solvent but is also a reactant to be hydrogenated, and as shown in **Table 1** (*reproduced below*) at page

109 thereof, when an amount of methanol is increased, the total conversion, X_T is markedly decreased.

Table 1

Total conversion, X_T , at 120 min on stream for different methanol: benzene ratios

Methanol:benzene (v/v)	X_T (%)
0	10.8
0.1	9.5
0.3	8.8
1.0	2.8
3.0	2.5

According to the description of **Mazzieri et al.**, the conversion to cyclohexene exhibits a maximum for a methanol:benene ratios, where it can be seen that the optimum ratio is 0.1 (see page 109, lines 3 to 5 under Table 1 of **Mazzieri et al.** (reproduced below)).

Figure 1 shows the conversion to cyclohexene as a function of time, indicating that the highest conversion is obtained for a methanol:benzene ratio 0.1. Figure 2 presents the conversion to cyclohexene as a function of total conversion for different methanol:benzene ratios, where it can also be seen that the optimum ratio is 0.1.

Moreover, the **Mazzieri et al.** description at page 111, lines 5 to 3 from the bottom of the same page that “we have also found an optimum methanol:benzene ratio of 0.1 for the conversion to cyclohexene.”

In order to more clearly show the advantages of the present invention over the combination of **Cornubert et al.** and **Mazzieri et al.**, one of the inventors has carried out a comparative experiment as shown in the attached **37 CFR § 1.132 Declaration** of Mr. Hidetaka Shima (one of the instant inventors) wherein the solvent of ethanol used in **Cornubert et al.** has replaced with the optimum ratio (methanol:benzene=0.1:1) of **Mazzieri et al.**

As can be clearly seen from the results shown in Mr. Shima's attached 37 CFR § 1.132 Declaration, the yield of the reaction resulting from the combination of **Cornubert et al.** and **Mazzieri et al.** was 55%, which is lower than that of ethanol alone (**Cornubert et al.**).

Thus, even if a person of ordinary skill in the art were to refer to **Cornubert et al.** in view of **Mazzieri et al.**, no good result can be obtained by their combination, such that a person of ordinary skill in the art could never expect to reach the constitution of the present invention or the advantageous properties that are possessed thereby.

According to the above, it is submitted that the present invention as claimed is in no way rendered obvious by the combination of **Cornubert et al.** in view of **Mazzieri et al.** Any contentions of the USPTO to the contrary must be reconsidered at present.

Distinctions over Fosker et al. in view of Mazzieri et al.

Fosker et al. discloses in Example 2, lines 2 to 6 thereof that chelidonic acid (76 g) was thermally decarboxylated and re-distilled to give pyran-4-one (19.5 g) which was then hydrogenated in methanol (200 ml) at atmospheric pressure for one hour using 5% palladium/calcium carbonate (9.0 g) as catalyst. After removal of the catalyst and the solvent, the concentrate was distilled to yield tetrahydropyran-4-one [(14.0 g) b.p. 162-4°].

In **Fosker et al.**, 14.0 g of tetrahydropyran-4-one was obtained from 19.5 g of pyran-4-one, so that the yield of the product was $(14.0/100)/(19.5/96) \times 100 = 68.9\%$. The yield of **Fosker et al.**, is lower than that of the present invention.

Distinctions over **Mazzieri et al.** are the same as those mentioned above.

In order to more clearly show the advantages of the present invention over the combination of **Fosker et al.** and **Mazzieri et al.**, a comparative experiment has been carried out

by one of the instant inventors (i.e., Mr. Shima) as shown in the attached 37 CFR § 1.132 Declaration, wherein the solvent of ethanol used in **Fosker et al.** is replaced with the optimum ratio (methanol:benzene=0.1:1) of **Mazzieri et al.**

As can be clearly seen from the results shown in the attached 37 CFR § 1.132 Declaration, the yield of the reaction resulting from the combination of **Fosker et al.** and **Mazzieri et al.** was 0% (no tetrahydropyran-4-one was obtained in this system), which is markedly lower than that of methanol alone (**Fosker et al.**).

Thus, even if a person of ordinary skill in the art were to refer to **Fosker et al.** in view of **Mazzieri et al.**, no good result can be obtained, such that the person of ordinary skill in the art could never expect to reach the constitution of the present invention or the advantageous properties that are possessed thereby.

According to the above, it is submitted that the present invention as claimed is in no way rendered obvious by the combination of **Fosker et al.** in view of **Mazzieri et al.** Any contentions of the USPTO to the contrary must be reconsidered at present.

In addition to the above comments and considerations, it is noted that the cited art being applied by the USPTO completely fails to provide any reason or rationale to those of ordinary skill in the art that would allow them to arrive at the instant invention as claimed. This fact also supports the non-obviousness of the instant invention as claimed.

CONCLUSION

Based upon the amendments and remarks presented herein, the Examiner is respectfully requested to issue a Notice of Allowance clearly indicating that each of the pending claims 1, 3-5, 7 and 25-33 is allowable under the provisions of Title 35 of the United States Code.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact John W. Bailey, Reg. No. 32,881 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Director is hereby authorized in this, concurrent, and future replies to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

Dated: December 11, 2009

Respectfully submitted,

By 

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Attachment: 37 CFR § 1.132 Declaration of Mr. Hidetaka SHIMA (4 pages)